THE MORPHOLOGIC ASPECT OF INTELLIGENCE. By Sante Naccarati, M.D., ScD., Ph.D. Columbia University Contributions to Philosophy and Psychology, Volume 27, No. 2. Cloth. Price, $1.10. Pp. 44. New York: G. E. Stechert & Co., 1921.

This little book contains one or two very suggestive ideas. Naccarati concerns himself with attempting to show that the macrosplanchnics, whose trunks are larger than average in proportion to the limbs, neck and head, are less intelligent than the microsplanchnics, whose trunks are relatively small. This fact may be related to the idea that the trunk is the seat of the vegetative functions, matters purely of maintenance of life, whereas it is by means of the rest of the organism, the organs of locomotion and intelligence, that man makes and maintains his contacts with the rest of the world, and a man's intelligence is judged by the success of these contacts. There are some tables of measurements of interest to the seeker after academic information.

Not. JAMA Apr. 1, 1922
78:

H. Gray
May 1922

THE MORPHOLOGIC ASPECT OF INTELLIGENCE

BY

SANTE NACCARATI, M.D., Sc.D., Ph.D.

ARCHIVES OF PSYCHOLOGY

EDITED BY

R. S. WOODWORTH

No. 45, August, 1921

Columbia University Contributions to Philosophy and Psychology

Volume XXVII, No. 2

NEW YORK

1921

Agents: G. E. STECHERT & CO., London (2 Star Yard, Carey St., W. C.);
Paris (16, rue de Condé).

THE MORPHOLOGIC ASPECT OF INTELLIGENCE

The problem of the correlation between bodily and mental traits has attracted the attention of educators, psychologists, physicians and sociologists during the last few decades.

For a great many years the problem has been laid merely on hypothesis and studied empirically; but only in recent years, namely after the introduction of the mental tests, has it been possible to approach the same with rational methods and to put it on a scientific basis.

In the matter of correlation with intelligence it must be admitted however that, while in the study of the tests for physical and motor capacity, different investigators have reported satisfactory and usually rather concordant results, the so-called anthropometric tests are still the subject of discrepancies and controversies.

Of course today we possess better scales for measuring intelligence; but the use of less accurate scales for intelligence on which former investigators had to rely alone does not justify the contrasting results obtained in the study of correlation between intelligence and anthropometric traits, such as height, weight, skull diameter, cephalic index, etc.

If we take height for instance, we find that Kline [1] reports that boys in public schools are taller than boys in truant schools. Smedley [2] reports that boys in the schools for incorrigibles and truants are shorter than normal boys, and that bright children are taller than dull children. These conclusions of Smedley's agree with those of Sack,[3] Gratianoff,[4] Porter,[5] Mac Donald,[6] De Busk [7] and others; while West [8] found the opposite to be true and Gilbert [9] failed to find any definite correlation between height and mental ability.

Again if we take weight, we find that Porter,[5] Smedley [2] and De Busk [7] reported that bright children are heavier than dull children of the same age; while for West [8] and Gilbert [9] the reverse is true.

The same conflicting reports were given by investigators who studied cephalic index, lung capacity, facial measurements, color of eyes, etc.

No wonder the results are so diverse. A single anthropometric measurement cannot constitute the characteristic of such a complex mental trait as intelligence, to which so many factors contribute.

Moreover height, weight, and cephalic index are traits much more constant than intelligence in the different races.

I cannot enter here in the discussion of Boas' views regarding the instability of the cephalic index. Probably Boas' contention has a scientific basis, if we consider that there is a certain correlation between the cephalic index and the morphologic type of the individual; therefore a modification of the cephalic index as a consequence of the transformation of the morphologic types produced by environmental factors through generations may be expected.

In the matter of height it may be said that, aside from external factors (environmental, social, political), an ethnic group tends to keep its average stature.

If we make a study of the population of the globe, we find people having tall, medium and short stature scattered all over from the very tall (m. 1.999) to the very short (m. 1.209) pygmies of Central Africa, not speaking of the pathological statures which are found beyond these extremes.

Now to admit that there exists a constant, definite correlation of height-intelligence would mean that all the people having a short stature, such as Lapps, Eskimos, Japanese, Hottentots, Negritos, Senois, etc. are not intelligent; and that people having tall stature such as Curds, Malays, Patagonians, Dinkas, inhabitants of some islands of the Pacific, etc. are intelligent, if we put them together, regardless of their respective race.

Everyone can see how absurd such an assumption would be, as any ethnic group includes in its community intelligent and unintelligent individuals. Of course if races could be kept pure, a physical trait such as height or weight may have a significance amongst the individuals of the same ethnic group; but nowadays with the continuous intermixture of races and with the great difficulty in differentiating the stocks from which the individuals spring, in cosmopolitan countries, one would do injustice to all the short individuals who originate from races having short statures, by regarding them less intelligent than the tall individuals of the same community, who owe their tall stature to hereditary factors.

The same may be said when weight or cephalic index are considered in connection with intelligence.

MORPHOLOGIC TYPES

After this consideration, it is obvious that none of the anthropologic traits alone could solve the problem of correlation with intelligence. As I said above intelligence is a most complex trait, therefore, I believe that any physical trait in order to be a correlative of intelligence must be a compound one, namely it must be a trait made up of many elementary traits.

Starting from this point of view I have made an anthropologic study of groups of individuals, aiming at the research of the morphologic characteristics of the intelligent type. This study has led me to the introduction of the morphologic index, following the criterion of the morphologic types individualized by De Giovanni [10] and Viola [11] for clinical purposes.

Viola, starting from the anthropometric studies of Broca, Bouchard, Manouvrier, Benecke and especially of his teacher De Giovanni, the founder of the clinical anthropology, and following the lines traced by the "Biometrika" in the study of the problems of evolution, after a diligent anthropometric study of 400 subjects, formulated his "law of deformation of the ethnic type," which reads as follows: "Individuals having a small trunk tend to assume a longilinear body which corresponds to the phtisic habitus; individuals having a large trunk tend to assume a short body which corresponds to the apopleptic habitus; individuals having a normal trunk tend to maintain normal proportions of the body." The so-called phtisic and apopleptic habitus are old denominations used by the ancient physicians to designate respectively a long thin and a short broad physical constitution.

According to the volume of the trunk in relation to the other portions of the body, Viola differentiated three morphologic types, the microsplanchnic, the macrosplanchnic and the normosplanchnic.

Microsplanchnics are individuals possessing a small trunk so that the development of the limbs is in excess over it, that is the vertical diameters predominate over the horizontal diameters in the body as a whole and in its constituents, trunk, extremities and portions of the extremities.

Macrosplanchnics or *Megalosplanchnics* are individuals possessing a large trunk which is excessively developed in comparison with the limbs; that is the horizontal diameters are prominent in comparison

with the vertical diameters in the body as a whole and in its constituents, trunk, extremities and portions of the extremities.

Between these two opposite types are the *normosplanchnics* who represent individuals in which trunk and limbs show a harmonious development, in as much as neither one, when the numerical value of each is taken, predominates over the other; that is there exists a constant proportional relation between the horizontal and the vertical diameters of the body.

Of course it is difficult to draw a line of demarcation between the microsplanchnic and the normosplanchnic on one side, and between the macrosplanchnic and the normosplanchnic on the other. There is a great deal of overlapping. Viola among 400 subjects representing an ethnic group of Northern Italy found that 47.7% were normosplanchnic, 28% were megalosplanchnic and 24.3% were microsplanchnic. In making this classification he proceeds by finding the middle normal ethnic type and then calculates in degrees the deviations above and below the normal.

The limits in which this dissertation must be kept does not permit me to enter into the details of Viola's work. Students of Medicine and of Anthropology, who may be interested in it, are referred to the original publications given in the bibliography. My present problem is concerned with the ranking of groups of individuals when intelligence and morphologic aspect are taken as scales. Once we find a criterion for comparing the individuals of a given group, we will be able to rank them.

In order to put in a numerical form the morphologic characteristics of a group of individuals, one has to find the measure-value of the trunk and the measure-value of the limbs. The trunk, as Viola observes, contains the organs of the vegetative life, which represent the nutritional system. These organs fulfill a task different from the muscular and nervous systems and skeleton, which constitute the animal system or a system that mediates contact with the external world. These two systems show a certain degree of independence and even antagonism during the development; in the sense that they do not grow simultaneously, but in alternate phases; and the more an organism develops the animal system, the less it develops the vegetative system when considered in relation of their reciprocal dependence.

The difficult task confronted in this study is to find the value of the trunk, namely the volume of the abdominal and thoracic cavities.

Viola takes 11 measurements, namely:

1. *Height.*

2. *Length of sternum:* (A B)—from the jugular incisure to the point of insertion of the ensiform appendix.

3. *Length xipho-epigastric:* (B C)—from the point of insertion of the xiphoid appendix to the epigastric point. This point (C) is at the crossing of the middle vertical line of the trunk with the horizontal line passing through the lower margin of the tenth rib (Z W).

4. *Length epigastric-pubic:* (C D)—from the epigastric point to the upper margin of the pubis.

5. *Length of the lower extremities:* (V T)—from the upper margin of the pubic bone to the external malleous of the foot.

6. *Length of the upper extremities:* (R S)—from the margin of the acromion process to the wrist-joint while the arms hang down; (I have preferred the stiloid process of the radius as point of repere).

7. *Transverse thoracic diameter* or breadth diameter taken at the level of the 4th rib (E F).

8. *Antero-posterior thoracic diameter* or depth diameter taken also at the level of the 4th rib (M N).

9. *Transverse epigastric diameter* taken at the mid-point of the xipho-epigastric line (G H).

10. *Antero-posterior epigastric diameter* taken as the same level of the preceding diameter (P Q).

11. *Transverse pelvic diameter* taken between the iliac crestae at the point of the maximum breadth (I L).

(For the explanation of letters in parentheses see figure 1 and the annexed anthropometric blank.)

Viola has devised special instruments for the morphologic measurements, but one who is familiar with anthropometry can obtain practically the same results with a little more time and patience, by using an anthropometric tape, a chest depth caliper, a chest breadth caliper and a height stand.

For the treatment of the anthropometric data Viola proceeds in the following way:

He obtains a *thoracic index* or a *thoracic value* by multiplying the length of the sternum by the transverse thoracic diameter and by the antero-posterior thoracic diameter ($AB \times EF \times MN$). By multiplying the length xipho-epigastric by the transverse epigastric diameter and by the antero-posterior epigastric diameter he obtains the *index of the upper abdomen* ($BC \times GH \times PQ$). *The index of the lower abdomen* is obtained by multiplying the length pubo-epigastric by the transverse pelvic diameter and by the antero-posterior epigastric diameter ($CD \times IL \times PQ$), (the antero-posterior pelvic diameter is not taken).

Sum of the indices of the upper and lower abdomen gives the *total abdominal value.*

Sum of the thoracic value with the total abdominal value gives the *value of the trunk.*

The value of the limbs is obtained by adding the length of one of the upper limbs with that of one lower limb (RS+TV).

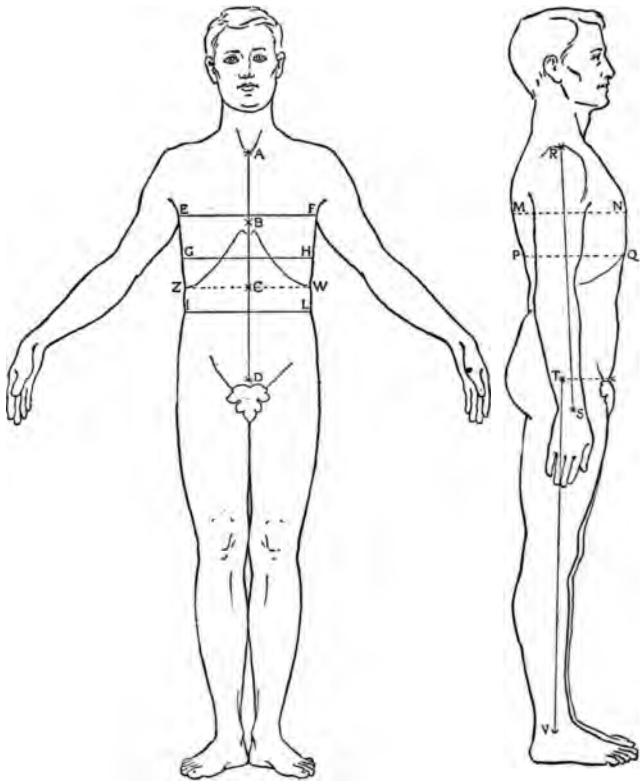

FIG. I. Showing how measurements are taken. For the explanation of the symbols see below.

ANTHROPOMETRIC BLANK

No. . . . . Name . . . . Age . . . .
Address . . . .

1. Length of sternum	AB . . .		AD
2. Xipho-epigastric line	BC . . .		
3. Pubo-epigastric line	CD . . .		
4. Transverse thoracic diameter	EF		
5. Antero-posterior thoracic diameter	MN		
6. Transverse epigastric diameter	GH		
7. Antero-posterior epigastric diameter . . .	PQ		
8. Transverse pelvic diameter	IL		
9. Length of upper extremity	RS		
10. Length of lower extremity	TV		
11. Height			
12. Weight			

MORPHOLOGIC INDEX AS AN INDICATOR OF INTELLIGENCE

For a long time I have observed that bright individuals during the period of growth in length tend to maintain the vertical diameters of the body and of the components of the body, trunk and extremities, relatively in excess over the respective horizontal diameters, when compared with less bright or dull individuals. In other words bright boys tend to grow in length rather than in width in a relatively greater proportion than dull boys of the same chronological age: that is what made me think that bright boys tend toward *microsplanchny*. Therefore I came to the conclusion that the very bright child is likely to be microsplanchnic, not merely feeble in health, as it was the pretension of a common belief, now pretty thoroughly exploded.

In order to demonstrate my theory, I have first tried to find an anthropometric index which could take in account the length of the extremities and the volume of the trunk with the purpose of correlating it with the intelligence score.

The index which I first used, and which I have named "*morphologic index*"[1] is given by the ratio of length of the limbs to value of the trunk. The higher indices will represent the microsplanchnics, the lower indices the macrosplanchnics. In other words if we distribute a group of individuals on a frequency curve, according to their morphologic index, we should find the microsplanchnics and macrosplanchnics occupying the ends of the curve and the normosplanchnics the center. As I said above, I have not tried to fix the limits between the three types: there is much overlapping.

After an anthropometric study of two groups of 50 and 75 students respectively, I found that there exists a positive correlation of +.7 and even more between the ratio of height to weight, and the ratio of limbs value to trunk value: therefore, I assumed the ratio of height to weight as an approximate indicator of the morphologic index, and took that ratio as a simpler method

[1] Bean has presented a paper on "The Morphologic Index" at the 37th session of the American Association of Anatomists, March 24–26 of this year. For this author the morphologic index represents the percentage above or below the world average of any anthropometric character, such as stature, cephalic index, nasal index, etc.

I like to call the attention of the reader to the fact that Bean's morphologic index is entirely different from mine, and that his conception on the morphologic types does not correspond to that of the Italian school.

of study for several other groups, whose morphologic measurements could not be taken, without pretending that the ratio of height to weight may substitute the morphologic index all the time when correlating mental traits.

The advantages of using the morphologic index or the ratio of height to weight over either height or weight alone, in the correlation with mental traits, are obvious.

One does not need to be tall in order to be microsplanchnic nor does the macrosplanchnic need to be short. In my groups one can find short subjects among the microsplanchnics and tall subjects among the macrosplanchnics. Microsplanchnics, macrosplanchnics and normosplanchnics are found almost in the same proportions in all the ethnic groups, and one does not need to look into remote ancestry of the individuals in a cosmopolitan community. Without denying that an ethnic group may give more individuals of a definite morphologic type in the same way as it may give more intelligent or less intelligent types, it must be admitted though that such influence of a predominant morphologic type in a stock is never so great as stature. Predominancy of a given type is undoubtedly well pronounced in the three different human races, white, yellow and black. In this respect Stratz's [12] distinction of the human types in (A) *Leukederm* (white races) in which limbs and trunk are proportionately developed, (B) *Melanoderm* (Negro races) in which exists an excess of the limbs over the trunk, (C) *Xantoderm* (yellow races) in which exists an excess of the trunk over the limbs, has to be kept in mind when studying groups of subjects, in order that the groups may be kept homegeneous.

Ranke [13] divided the human races into races of culture and races of nature including in the first group the white and the yellows who tend to brachyskely (short limbs) and in the second group the negroes who tend to dolichoskely (long limbs). Of course in the mind of the German anthropologist no hint existed as to the conception of hyperevolution and hypoevolution of the individuals brought forward in the differentiation of the two opposite types the microsplanchnic and the macrosplanchnic. His study was racial and his distinction after all was theoretical, because there are people of culture showing both dolichoskely and brachyskely, as *e.g.* Mediterranean and Baltic races respectively brachyskele and dolichoskele, and people of nature such as Bushmen and Australians respectively brachyskele and dolichoskele. From the individual point of view we consider the dolichoskele type of culture and the brachyskele type of nature, whether macrosomatic or microsomatic.

Recent attempts are being made to correlate facial measurements

with intelligence, but the method by which the problem has been approached is not free from phrenological influence. I think though that combined head and face measurements may lead to some practical results if they are directed to the discovery of fœtal characteristics in adults which would indicate hypoevolution of the individual. The same may be said of the intermembrae index, of the vital index of Goldstein and of any other indices intended to bring forward morphologic signs suggestive of physical hypoevolution. However it must be remembered that in the matter of head and face measurements we have to deal with small differences, which increase the sources of error and give very little chance for comparison.

The assumption I made that intelligent subjects are more likely to be found among microsplanchnics than among macrosplanchnics is based on these three physiological facts:

1. The relative independence existing in the growth of the two great systems, differentiated by Bichat, namely the nutritional or vegetative system, in which energy is stored up, and the animal system (mainly organs of locomotion) by which energy is transformed and utilized or wasted.

2. The physical hyperevolution of the microsplanchnic type which hyperevolution I think must exist also for the mental characteristics.

3. The microsplanchnics correspond to the hyperthyroid types.

Regarding the first fact, I have to add that by the term animal system is meant the nervous system, the muscles and the skeleton, which are systems of relation in as much as they mediate contact between the individual and the external world. They constitute about 60% of the total weight of the body.

In general there is a positive correlation between the growth of the internal organs and all the other systems: but the rate of growth of the internal organs and of the other tissues which constitute the system of nutrition or vegetative life, when considered in relation to the other organs and apparatus constituting the animal system, is not the same in microsplanchnics and macrosplanchnics. This rate during the period of development is subject to individual variations which have not been well estimated so far. Generally speaking it may be said that in normosplanchnic subjects it is kept relatively constant and proportionate, but in macrosplanchnics and microsplanchnics the rate of growth of one system (nutritional) does not correspond, in relation of reciprocal dependence, to the rate of the other system (animal) and vice versa. Therefore the microsplanchnic is apt to develop relatively more in the animal system, the macrosplanchnic more in the vegetative system.

One may observe that muscles and bones constitute the greater part of the weight of the body, whereas the viscera represent a small fraction. Judging from this point of view weight should constitute a positive and not a negative factor as it appears from the correlation between ratio height to weight and intelligence. While this cannot be denied, it must be admitted though that in true macrosplanchnic types the weight of the viscera, fat and cutaneous annexes, which in normosplanchnic individuals represent about 40% of the body weight, go beyond the 40% at the expenses of the systems of the animal life. In some individuals having tendency to obesity the muscular fibers are usually infiltrated with adipose tissue; therefore even a method which could give the absolute weight of the striated muscles, such as the volumetric estimation of a limb by displacement of fluid, would not be free from error because it would not take into account the quality of the muscular system.

But there is another element to be considered in the larger volumetric or ponderal mass of the muscles of the macrosplanchnic. The macrosplanchnics, having short limbs, have also short muscles and smaller portion of attachment on the bones: this, Viola points out, means that the muscular system was *primarily* deficient and only *secondarily* became excessive, owing to the increase in size and number of muscular fibers due to the excessive nutritional activity of the organism. Besides a short large muscle may have advantage over a long thin muscle in what concerns amount or quantity of energy, not in what concerns quality of achievement; a thin long muscle may give poorer but more highly specialized movements.

The substitution of the ratio of height to weight for the morphologic index practically eliminates the error due to muscle influence, in as much as the muscles of the limbs are neither added nor subtracted in our calculation. For this reason probably the correlation morphologic index-intelligence was found larger than the correlation ratio height to weight-intelligence. At any rate even the morphologic index is not free from errors of computation.

Since an ideal method which could give the exact value of both the animal and the vegetative systems, taking into account quantity and quality, in living subjects is not possible, we have to be satisfied with methods which give us approximate values.

Regarding the second fact, here is the summary of the proofs brought by Viola to demonstrate that the microsplanchnic is a hyperevolute type and the macrosplanchnic is hypoevolute from the point of view of physical development.

All the characteristics which differentiate the newborn from the

adult are found in the macrosplanchnics; all the characteristics of the adult are found in the microsplanchnics in an exaggerated form. The microsplanchnics in comparison with the normosplanchnics show: thorax flatter *in toto*, narrower at the basis and more predominant in volume over the abdomen; umbilicus more distant from the pubis; ribs more inclined; costo-vertebral angles smaller; heart more vertical; the thorax has an expiratory shape; diaphragmatic vault is pronouncedly convex toward the thorax; lungs longer; Luska's incisure well accentuated; lower extremities more developed in comparison with the upper extremities; hands and feet longer; arch of foot more pronounced.

In macrosplanchnics, as in newborn, the system of vegetative life prevails over the system of animal life. During the period of growth the visceral system gradually decreases, passing from the infantile megalosplanchnic to the normosplanchnic or to the microsplanchnic. Thus the macrosplanchnic adult has been left behind in its development in comparison with the normosplanchnic, while the microsplanchnic has gone beyond.

The characteristics which liken the macrosplanchnic to the newborn and differentiate him from the normosplanchnic are: relatively larger size of liver, spleen and other abdominal organs; abdomen predominant in volume over the thorax; thorax larger at the base; antero-posterior thoracic diameter larger and prominent over the transverse diameter; (the antero-posterior thoracic diameter is gradually reduced during ontogenesis, while the transverse diameter is increased); less of forward inclination of the ribs; costo-vertebral angles larger; more forward projection of the sternum; lungs shorter; thorax has a general inspiratory shape; diaphragmatic vault is almost flat; lower extremities are relatively short in comparison with the upper extremities; flat foot; broad hands and feet.

There are other points of differentiation between the two opposite types macrosplanchnic and microsplanchnic, which bear no little weight on the general activity of the organism, particularly on the nervous reactions.

The megalosplanchnics have a rather small cutaneous surface in relation to their body volume, whereas microsplanchnics have a relatively larger cutaneous surface and a small body volume. The first have little dispersion of heat, the second have a great dispersion. When we come to consider that the 9/10 of the total energy of an organism is dispersed under form of heat, we must conclude that such a great dispersion is not a waste of energy to the organism but an employment somehow and somewhere beneficial to it, al-

though we are still unable to discover how and where this employment takes place. If such enormous dispersion is necessary for biological potential activities yet unknown to us, we may suppose that microsplanchnics must gain some sort of compensatory advantages for their larger dispersion of heat.

External stimuli, which have so much influence on our nervous system and, therefore, on our mood and behavior must necessarily act in a different way on the relatively larger receptive surface of the microsplanchnic and on the relatively small cutaneous surface of the macrosplanchnic. Take for instance such cosmic stimuli as sun heat, sun light, barometric pressure, etc., we all know how much influence they have on our mood and consequently on our behavior. We usually give importance to the atmospheric conditions in a general sense, but we never take into consideration the important element of our somatic individuality. Now the macrosplanchnics having a relatively reduced receptive surface for the external stimuli must have retarded nervous reactions, comparatively little sensitive life, lessened psychic functions: whereas the opposite must be true of the microsplanchnics who will be quicker but more exhaustible in their nervous reactions, and will possess a greater degree of sensitiveness to pain, thermal and electric stimuli.

Regarding the third fact, it is nowadays accepted by endocrinologists that in physiological hyperthyroidism the organism tends to grow more along the vertical diameters, namely it tends to grow in length rather than in width. Thyroid hormones have some relationship with intelligence. Witness cretinism and the manifold indications which come to us from clinical cases. Schlesinger (13) has recently reported that in a region where goiter is endemic, the growth and development of the children with this hyperthyroidism are usually in advance of their years, both physically and mentally.

Now a few points must be made clear before concluding.

I do not say that intelligence can be measured with ratio of length of limbs to volume of the trunk, or with ratio of height to weight in the sense that the higher the morphologic index is, the more intelligent is the subject and vice versa. Probably the best intelligence is not found among the highest microsplanchnics, as these are likely to be borderline pathologic cases. I simply say that generally speaking individuals showing a microsplanchnic type in a given group have more likelihood to be intelligent, than those who have a macrosplanchnic tendency. Normosplanchnics show all degrees of intelligence. Usually they tend to normality also in the intellectual domain. If we wanted to calculate the degree of intelligence by the degree of *microsplanchny*, we would err, in as much as the ultramicrosplanch-

nic types are pathological subjects who have attained that high morphologic index in consequence of exhausting diseases, usually tuberculosis. The volume of the trunk in my 125 individuals ranges from a minimum of 17.57, found in a healthy boy 17 years old to a maximum of 40.68, found in a subject 30 years of age. Viola found in 400 Northern Italian subjects a minimum of 18.28 and a maximum of 58.96, having taken subjects much older than mine and concluded that below a value of 18.28 for the trunk, human existance becomes highly improbable beyond the age of 20. Undoubtedly Viola's conclusion is correct. Above the age of 20, a value of trunk below 18 can be found only in pathological cases, in the white race.

One must not think that *microsplanchny* is usually the outcome of exhaustion as in tuberculosis and of excess of mental work and reduced diet in students, as it may appear at first sight. The morphologic type is outlined during the period of growth as the exponent of internal factors which, we know now, are intimately connected with the function of the endocrines. The diet of a microsplanchnic may be increased and enriched; the subject will gain a few pounds but will not lose his morphologic individuality in the sense that he will become a macrosplanchnic, unless functional or pathological changes in the endocrine glands occur. The microsplanchnic being a hyperthyroid possesses a constitutionally weak digestive system and a poor assimilative power, therefore overfeeding if protracted will be injurious rather than beneficial. Conversely an elimination diet will not effect the transformation of a macrosplanchnic into a microsplanchnic, without danger to the organism.

Of course from the 25th to the 35th year of age the thorax expands laterally. Besides physiological factors, such as pregnancy and menopause in women, environmental factors such as change of climate, occupation, marriage, etc., and diseases may induce profound modifications within the internal secretory glands and thus the altered metabolism may cause great gain or loss of weight after the age of 25. In this way the morphologic type may be transformed from what it was primarily. But this transformation is unusual in normal individuals before the growth in length has ceased; therefore, when speaking of the morphologic type of an adult, one has to refer to measurements taken before the age of 25 years. For this important reason I have taken college students considering that at the age of 20 the individual has attained the 99% of his stature. Measurements taken in subjects older than 25 may give the fallacious impression that we have to deal with macrosplanchnics in individuals who were primarily normosplanchnic or

even microsplanchnic. This fact must be kept in mind when taking morphologic indices for correlation with intelligence.

When I say that measurements should be taken between the ages of 20 and 25, I do not deny that the same, if taken in children and in adolescents and in older individuals may give good results. Children and youths may be suitable subjects for morphological experiments provided they be grouped according to their respective physiological ages. This fact is important because, as it is known from physiology, at about the seventh year of age and at the puberal period the organism shows a rapid growth in length and therefore it tends toward *microsplanchny:* whereas during infancy, after the 25th year of age, and a few years before pubescence it shows a definite tendency toward *macrosplanchny.* Thus in each normal individual the highest degree of *microsplanchny* is attained at puberty, while the highest degree of *macrosplanchny* exists at birth.

According to Pende (15), during the periods of greater growth in height, a physiologic hyperactivity of the hormones, which promote the development of the animal system, exists, i.e. some hormones of the thyroid, of the hypophysis, of the cromaffin tissue, of the endocrine tissue of the sex glands. These hormones promote and stimulate also the neuropsychic activity, and possess a certain degree of inhibition over the hormones which favor the nutritional or vegetative system.

I feel justified in making the foregoing statements, because I believe that some of the hormones, chiefly thyroid hormones, which during the period of growth regulate the morphology of the body, influence also the development of the mentality. Mind in the same way as the body is shaped before the subject has attained his full stature, and we may have some idea of the hormonic actions exerted upon the mind, looking through the morphologic type.

Summing up, in saying that the microsplanchnic type is the intelligent individual, I do not extend the assumption to pathological cases, nor do I affirm that the macrosplanchnic type cannot be intelligent. This statement must be made clear in order to avoid erroneous interpretations of my theory, which are likely to follow in the form of criticism, as was true in the case of Lombroso's theory on the somatic features of the criminal, so that every mark of degeneracy was taken to mean an indication of criminality or degeneration, an assertion which Lombroso never made.

HORMONES AND MORPHOLOGIC TYPES

Although we do not yet possess a full knowledge of the different hormones of each of the ductless glands and therefore their respective definite functions, physiological and clinical observation enable us to make a tentative classification of the different morphologic types studied from the endocrine point of view. In the *microsplanchnic* type we find characteristic features of hyperthyroidism of hyperpituitarism and hypogenitalism, while in the *macrosplanchnic* type we find characteristics of the hypothyroidism, hypopituitarism and to some an extent also of hyperadreninism (to limit ourselves to the study of those glands whose function is better known).

Of course what was said for the morphologic types namely that a sharp line of demarcation between the microsplanchnic type and the normosplanchnic type on one side and between the macrosplanchnic type and the normosplanchnic type on the other, cannot be drawn since both microsplanchnic and macrosplanchnic types merge into the normosplanchnic type when a group of individuals is recorded on a frequency curve, is also true for the hyperthyroids and hyperpituitarics on the one side and hypothyroids and hypopituitarics on the other, in the sense that a sharp distinction between each of the two groups and the normal individuals does not exist. When we speak of hyperthyroids and hypothyroids of hyperpituitarics and hypopituitarics, we do not mean the real pathological cases but we refer only to those individuals having a constitutional or a congenital hyperactivity and hypoactivity respectively speaking which is kept under physiological limits. Pende and Levi and Rothschild have respectively named "Ortoplastic Hyperthyroidism" and "Hyperthyroid Temperament" a condition of constitutional hyperthyroidism in which the toxic and dysharmonic hormonic actions characterizing pathologic hyperthyroidism do not exist.

If we examine the microsplanchnic type we find many of the subjective and objective signs of hyperthyroidism viz: wide palpebral fissures, large pupils, glistening eye, long eye lashes, thin moist shining hair; well developed and healthy teeth and nails; hands and fingers long and thin, this being a part of the general tendency of the hyperthyroid to grow in length rather than in width; skin usually moist, especially that of the hands and feet which are also

warm, with tendency to show rapid vasomotor and secretory changes; digestion and assimilation irregular and defective, a condition which renders the hyperthyroids very cautious in the selection and use of food; circulatory system shows tendency to an inverted oculo-cardiac reflex (negative reflex index) (16), to tachicardia and to arterial hypertension, although pulse and blood pressure show large fluctuations during the same day; baldness and gray hair rare or late to appear.

Similarly as macrosplanchnics show somatic resemblance to infants, that is they keep the somatic characteristics of infants, the hyperthyroids (microsplanchnics) tend to preserve the somatic features of youth. For this reason the adult hyperthyroid looks younger and maintains a youthful complexion even in mature age. This is due to the fact that in hyperthyroids the hyperactivity of the hormones which promote the development of the animal system and which are very active throughout the period of growth in length, predominates even after the end of said period: while in the macrosplanchnics, the antagonistic group of hormones, which promote the development of the visceral system, instead of giving way to the other group of hormones at the proper time, has persisted in its physiologic hyperactivity thus giving the macrosplanchnic the infantile trend of the body.

Not less striking are the psychic characteristics of the hyperthyroids. As Viola observes, the microsplanchnic, owing to the possession of a minimal organic mass and a maximal surface area of the body, is by nature endowed with a strong catalytic stimulation and with an eretistic nervous system. His large receptive surface area renders him excitable, and any form of external influence affects his type more than any other. On account of their limited muscular expansion, the hyperthyroids do not indulge in athletic exercises and take little interest in the practical side of life but conversely acquire a great transport for its aesthetic side. Therefore the hyperthyroids love indoor games, music, poetry, arts in general, theatre, readings and works of the nature of scientific research. Also their minds not unlike their bodies tend to preserve the characteristics of youth, so they are rather prone to day dreaming and to being absent-minded. Being intelligent they possess live ideation, prompt perception, vast imagination, strong memory, and shrewd critique; but lack of concentration and unsteady will power may hinder their learning capacity. Cœnæsthetic variations are at the bottom of their exaggerated emotional display and of their rapid changes in mood which they often show. Most of the manic-depressive characteristics are found amongst the

hyperthyroids, who are likely to pass from one emotional state to the opposite one, from enthusiasm to pessimism for slight causes. Endowed with exquisite sensibility the hyperthyroid feels joys and griefs deeply; offenses and wrongs do not pass without a long and profound repercussion on his mood. Too much mental repression and the quick muscular exhaustion make the hyperthyroid a prospective candidate for the asthenic forms of psychoneurosis.

In general it must be said that the macrosplanchnics on account of their hyperactive vegetative functions show prominently acts and instinctive reactions, such as eating, sleeping, sexual impulse, etc., which satisfy the somatic self, whereas the microsplanchnics develop more the mechanisms intended to preserve the psychic self.

Intuition is one of the characteristics of hyperthyroids. When we consider this characteristic in connection with their quick physical and mental exhaustibility, a practical conclusion can be drawn from the point of view of vocational guidance. The intelligence of the hyperthyroid possesses more intensity than duration, it acts as a stored up energy which can be better employed as explosive material. Hyperthyroids should be directed toward those disciplines for which inventory capacity is needed; invention is in some respects intuition plus condensed mental energy which acts in an explosive manner. Occupations which require long, patient application and too much concentration are not fit for the bright but exhaustible hyperthyroid.

Conversely the macrosplanchnic, who possesses a vigorous *physique*, can persist longer than the microsplanchnic in any kind of physical and mental work. Therefore macrosplanchnics compensate with duration and amount of performances what they cannot accomplish by intensity and quality. The achievements of the macrosplanchnics are due to the determination and endurance they show in bringing about a given task. Rather by persistent application than by intuitive genius can they solve such difficult problems in which the microsplanchnics would hardly succeed, before reaching their limit of exhaustibility.

SURVEY OF EXPERIMENTAL WORK

This research work has been carried out on College and University students of the white race. The tests used correspond to the best hitherto devised for measuring intelligence, namely the "Alpha Army Test," the "Otis Intelligence Test," and "Thorndike Intelligence Examination Tests." The above mentioned tests, especially the ones devised by Thorndike, greatly reduce the chances of error in what concerns the measurement of one of the traits which I have correlated; *i.e.*, intelligence.

I omit the full description of these tests, as they can be easily obtained from the authors or publishers.

Tests embodying the principles of the "Alpha" and "Otis" scales were used on more than a million and a half men upon their entry into the United States army. They are designed to test general mental ability and are suitable for all literate persons. The scales of both Alpha and Otis tests consist of 8 to 10 tests respectively, each test consisting of a series of questions or problems. There are several forms of the Alpha test, and two forms of the Otis test, A and B; these forms, while different in substance are similar in structure; and the Total Point Scores of one Alpha Test form are equivalent to those of the other Alpha forms; likewise, the Total Point Scores of one Otis form are equivalent to those of the other Otis form. The purpose in constructing independent scales is to provide for reexamination after a short interval without the scores being influenced by memory of previous questions, and to prevent collusion between groups successively examined.

Without entering into the details of the scoring of the Alpha and the Otis tests, I simply mention that scores range from 0 to 212 for "Alpha" and from 0 to 230 for "Otis." In our groups scores ranged from 76 to 176 and from 121 to 220 respectively.

The Thorndike Intelligence Examination Tests were devised by Prof. Thorndike with the purpose of supplanting the old-fashioned examinations for students entering colleges, schools of engineering and Professional Schools. The good results obtained during the first two years these intelligence examinations were administered authorize us to consider their scores the best indicators of intelligence at the present time.

Here are a few points I take from the Standard Instructions:

The examination is composed of three parts. Part I comprises

two forms of 13 tests each: Part II comprises 8 tests, and Part III is made up of three tests, a total of 37 tests.

For the purpose of giving the student a notion of the examination he is to take, a fore-exercise with 13 tests of part I precedes the examination; the student being informed that this trial is not a part of the examination.

Part I comprises two examinations of the type of the army Alpha, but extended and made harder; part II and III are made up of examinations of different sorts, including the tests which have been found by Haggerty and Thorndike to be specially indicative of ability to succeed with the work of a college or professional school.

A Thorndike Intelligence examination can be administered in about 3½ hours, time being distributed as follows:

10 minutes for fore-exercise with Part I, Practice Form.
30 " Trial I with Part I, Form E.
30 " Trial II with Part I, Form F.
60 " Part II.
40 " Part III.
From 20 to 35 minutes for explanation, distribution of papers and rest period.

One examiner can take care of 40 to 50 men, if he is quick in distributing the material.

The score is determined by quality of achievement more than by speed, except in so far as the latter is an essential consequence or accompaniment of quality.

Scoring does not require great pains or special ability. Standard instructions and keys for scoring the tests are so arranged that any college officer can give the examination and that at least 80% of the tests can be scored by any clerk. With proper supervision and enough clerks, any number of tests can be scored in a single day.

The total scores vary from about 40 to 100 with a few records above 100.

Individuals 17 years old or older who score less than 60 are as a rule unsuitable material for college education. If under 17 they may be submitted to a second examination after one year's study. Individuals scoring from 60 to 69 have, perhaps, enough intellect to attain a college degree, if they are specially earnest and industrious. Individuals scoring 70 or over possess intellect such as is adequate for college work and may be admitted with no risk of detriment to present standards. Individuals scoring 85 or over may be safely admitted regardless of even gross deficiencies in their preparations.

The scores of the subjects studied by me range from a maximum

of 117 to a maximum of 54. Their ages vary from 17 to 22 years. Some were younger when they took the examination.

Aside from these college boys who constitute the greater number of my subjects, I have examined two other groups of 50 and 94 Summer Session students of both sexes, whose ages in many cases were above 25 years.

Except for the last two groups the anthropometric measurements were taken at the gymnasium in metric system units.

Regarding the reliability of the physical measurements a few points need to be explained.

Weight and height do not require any particular skill, with a good scale and a reliable stadiometer any intelligent examiner can claim to be accurate.

Some anatomical knowledge and anthropometric training is required before one can advance any claim to accuracy in the anthropometric measurements.

The anatomical points must be first established on the subject; it is better to mark them down with a dermographic pencil. The vertical measurements are taken between the marked points with an anthropometric tape. For the transverse and antero-posterior diameters of the trunk the *Seaver Rod Caliper*, which can be used for breadth as well as for depth measurements has served my purpose most satisfactorily.

Control measurements are advisable, as for instance in the case of the three first measurements Sternum, Xipho-epigastric line and Pubo-epigastric line, one should ascertain himself that the whole length Sternum-Pubis corresponds to the sum of the three different segments.

Measurements should be extended to millimeters. An error of 1 mm. will reduce or increase the index to about 10 counts. An error of ½ cm. plus or minus would cause a change of 50 counts in the index. This probable error in excess or in defect in all the measurements is of course rare, error usually occurring in one or two measurements with the probability of being compensated by errors in defects or if not compensated at all, with the modification of a few counts on the morphologic index. At any rate such errors will have no substantial influence on the correlation and in no instance will they effect the transformation of a microsplanchnic into a macrosplachnic and vice versa.

In the group of 75, the morphologic index ranges from 435 to 721. Now by disregarding the third digit the indices are computed from 43 to 72 making 30 steps, the correlation will persist.

In the group of 50 the morphologic index ranges from 360 to 671.

The reduction of the morphologic index in this group is due to age influence; after puberty the index diminishes as the age increases.

Complete anthropometric measurements were taken on:

1. A group of 50 students. Of these only a few returned for the Otis test, therefore, no correlation between morphologic index and intelligence could be studied. At any rate this group has served to demonstrate the correlation existing between the ratio height to weight and length of limbs to volume of the trunk, which had to be expected. The coefficient of this correlation has been found equal to + .75 with a P.E. of 0.05. The existence of a high positive correlation between morphologic index and ratio height to weight (as shown in this group and in the other group of 75) indicates without further explanation what is the factor which causes a positive correlation between ratio and intelligence.

2. A group of 75 students, who took the entrance examination test of Professor Thorndike. The coefficient of correlation was found equal to +.35, P.E., .068. The coefficient of correlation ratio height to weight-intelligence in this same group was only + .16, with a P.E. of .08. The co-efficient of correlation between ratio length of limbs to volume of trunk and ratio height to weight in this same group was found equal to + .70 with a P.E. of 0.04.

Ratio height to weight was correlated with intelligence in the other four groups, respectively of 50, 94, 80, 100 individuals. The group of 50 who were given the Alpha test and the group of 94 who were given the Otis test were studied in co-operation with Lewy Guinzburg. These tables will be given in another work when the measurements of a larger group, now under study, is completed. The coefficient of correlation were +. 44 and + .14 with P.E. equal to 0.06 and 0.07 respectively.

The groups of 80 and 100 as the other group of 75 were scored with the ratings obtained at the entrance examinations, given by Prof. Thorndike: they yielded coefficients of + .27, + .33, + .16 with P.E. of .07, .06, .08 respectively.

In order to reduce the P.E. I made a single group out of the three groups of 75, 80 and 100 subjects who took the same entrance examination test. As each of the three groups were taken at different times, it happened that a few students appeared in more than one group; therefore out of 245 students a group of 221 was obtained, whose correlation of the ratio of height to weight to intelligence gave a coefficient of + .228 with a P.E. of .044.

The ratio height to weight in the group of 221 ranges from 2.066 to 3.565.

I like to call the attention to the fact that the subjects used in my

research, being usually intelligent individuals who had resisted the practical elimination tests of school, offer small intelligence differences. If the same research is carried out on groups of individuals who did not receive high school education, the larger intelligence ranges which will be found will probably cause the correlation to be higher.

In none of the groups studied by me was any correlation found between height and intelligence, nor between lung capacity and intelligence, the latter being — .10 in 136 subjects.

Weight and volume of trunk yielded negative correlations with intelligence.

My correlation reviewed by a statistician (Wood) with different methods gave the following coefficients:

r 221	subjects,	Intelligence	—height	+.0415
" 221	"	"	—weight	−.183
" 221	"	"	—ratio H:W	+.230
" 75	"	"	—length of limbs	+.155
" 75	"	"	—volume of trunk	−.360
" 75	"	"	—morphologic index	+.356
" 136	"	"	—lung capacity	−.105

SUMMARY

1. Intelligence cannot be correlated with a simple physical trait such as height, weight, cephalic index, etc. A basis for correlation must be found in a compound physical trait which is made up of several anthropometric traits.
2. By morphologic type is meant the physical constitution of the individual when the development of the extremities and that of the trunk are reciprocally considered and compared. The "Morphologic index" of an individual is given by the ratio value of the extremities (length of one upper and one lower limb) to the volume of the trunk.
3. Among the three morphologic types differentiated by Viola, viz: the microsplanchnic, the normosplanchnic and the macrosplanchnic, the microsplanchnic gives the more intelligent units. This does not mean that the normosplanchnics and the macrosplanchnics are not intelligent. Normosplanchnics represent all degrees of intelligence: macrosplanchnics, while representing a less intelligent group, individually may be as intelligent as any other type.
4. The microsplanchnic type, being an intelligent type, is mentally hyperevolute. This fact constitutes another proof in support of Viola's thesis that the macrosplanchnic type and not the microsplanchnic is an infantile type and therefore retarded in his development.
5. The microsplanchnic type corresponds to the hyperthyroid type, namely to an individual who possesses a constitutionally hyperactive thyroid, an "Orthoplastic Hyperthyroidism" (Pende), or a "Hyperthyroid Temperament" (Levi and Rothschild). In this respect my research may constitute support to the common belief that the thyroid function bears relationship to intelligence
6. The morphologic type is the outcome of hereditary and accidental factors. Hormonic actions, which, as we know from the study of the endocrine glands, influence the physical and mental growth, the metabolism and the nervous reactions, are in part responsible for the individual differences in the same family and in the same ethnic group.

   During the prenatal life and during infancy and the adolescent

period, environment, diseases, traumata (physical and moral) improper diet, etc., may affect the function of one or more endocrine glands, and thus produce morphologic deviations which are usually accompanied by mental deficiencies or gains on account of interrelations existing between the morphoregulator and the neuroregulator hormones.

After the age of 25 external factors such as marriage, occupation, diet, climate, etc., may cause changes in the organism by which the morphologic type may be more or less modified from what it primarily was. Therefore morphologic index and ratio height to weight taken in adults should be referred to the age of 25.

7. Owing to racial tendency toward brachiskely and dolichoskely, one should avoid putting together in the same group, when taking the morphologic index, individuals of different races (namely the white, the yellow and the negroid).
8. My experimental study has shown that a positive correlation exists between intelligence and the ratio of height to weight. The average coefficient of correlation found in the group of 221 students was equal to + .228 with a P.E. equal to .044.
9. The ratio of height to weight gives an approximate indication of the morphologic type of the individual, since there is a correlation of about + .7 or more between that ratio and the morphologic index, as shown by the analysis of 125 students, whose anthropometric measurements were taken.

   Individuals showing a high morphologic index and a high ratio of height to weight correspond to the microsplanchnics; the lower indices and lower ratios correspond to the macrosplanchnics.
10. A higher positive correlation is found when instead of the ratio of height to weight, the morphologic index is taken as the expression of the type of the subjects. The morphologic index is found by dividing the length value of the two limbs by the volumetric value of the trunk.

   A group of 75 male students which gave a correlation of +.16 with the ratio of height to weight gave a coefficient of +.35 and a P.E. equal to .068, with the morphologic index.
11. No correlation was found in any one of the groups examined between height and intelligence. Similarly no correlation was found to exist between lung capacity and intelligence in 136 of the students making the group of 221, whose lung capacity had been measured. Weight gave a negative correlation.

In conclusion I am indebted to Prof. Woodworth for the helpful suggestions given me in the course of this work, to Prof. Thorndike and Mr. Wood for the use of the Entrance Examinations ratings, and to Dr. Meylan for the opportunity of the Gymnasium rooms and instruments he afforded me for my anthropometric research.

TABLE I

No.	Height	Weight	Ratio H:W	Int. Score
1	171	59.3	2.883	117
2	165	64.5	2.558	114
3	154	47.6	3.235	107
4	166	62.1	2.673	107
5	166	54	3.074	104
6	166	56.2	2.954	104
7	165	53.1	3.107	103
8	184.5	54.2	3.404	101
9	167.6	61.2	2.739	101
10	174.4	64.7	2.695	100
11	166.5	55	3.027	100
12	170	62.3	2.729	100
13	165.5	60.1	2.754	99
14	173	62.5	2.768	98
15	162.8	56.4	2.887	98
16	164	48.1	3.411	97
17	167	78.6	2.125	94
18	177.1	55.8	3.174	93
19	175	52.7	3.320	93
20	162.5	70.1	2.318	92
21	178	57.2	3.112	91
22	165.4	51.1	3.236	91
23	168.4	59.3	2.840	90
24	171	59.4	2.879	90
25	155.1	43.1	3.598	89
26	171	60.8	2.812	89
27	149.5	53.5	2.794	88
28	180.1	84.8	2.124	88
29	168	65	2.584	88
30	166.5	65	2.562	88
31	167	53	3.151	87
32	170.4	58.1	2.933	87
33	165	54.2	3.044	86
34	175.5	58.9	2.980	86
35	181.6	60.7	2.992	86
36	177	55.3	3.201	86
37	175	65	2.692	86
38	167	58	2.879	86
39	170.5	58	2.940	85
40	178	63.4	2.808	85
41	176.1	59.6	2.955	85
42	166	54.4	3.051	85
43	171.5	60.5	2.835	84
44	174	69	2.521	84
45	183	69.5	2.633	84
46	176	52.4	3.368	84
47	173.9	66.3	2.623	84
48	163.6	52.6	3.110	84
49	174.4	59.5	2.931	83
50	179	68.5	2.613	83

TABLE I—(*Continued*)

No.	Height	Weight	Ratio H:W	Int. Score
51	171	58.6	2.918	83
52	164.9	70	2.356	82
53	174.4	64.4	2.708	82
54	174	60.8	2.861	82
55	168.8	55.7	3.030	81
56	166.6	60	2.777	81
57	166	63	2.635	81
58	162	48	3.375	80
59	183.2	67	2.734	80
60	179.3	70.2	2.554	80
61	169.1	65	2.602	79
62	175.4	61	2.875	79
63	164	46	3.565	78
64	159.1	65	2.448	78
65	170	56.6	3.003	77
66	157.7	59	2.673	76
67	162.5	62	2.621	75
68	169.6	61.3	2.767	74
69	166.3	68.3	2.435	74
70	184	61.1	3.011	74
71	182	69.5	2.619	73
72	162	63	2.571	73
73	168.7	66.3	2.544	72
74	163.4	59.2	2.760	72
75	172	69.2	2.485	72
76	181.6	72	2.522	71
77	161	66.5	2.421	69
78	180.1	68.4	2.633	69
79	173	56	3.089	69
80	171.8	56	3.068	68
81	177.4	68.2	2.601	68
82	169	55.6	3.219	68
83	176	66.5	2.647	68
84	170.3	54.3	3.136	67
85	165	62.2	2.653	66
86	176.5	66	2.674	66
87	171.5	83	2.066	66
88	171.5	61	2.811	65
89	170	67	2.537	65
90	171.4	62	2.764	65
91	168.3	56	3.005	65
92	177	68	2.603	65
93	166.4	74.2	2.243	65
94	179.5	74.5	2.409	64
95	178.3	64.7	2.756	64
96	176	65.5	2.687	64
97	163.3	60	2.722	62
98	176.5	73.8	2.392	62
99	172.2	64.9	2.653	60
100	187	81.4	2.297	59

TABLE II

No.	Height	Weight	Ratio H:W	Int. Score
1	175.5	61.1	2.872	71
2	182.7	62	2.947	95
3	163.7	49.3	3.320	78
4	184	61.1	3.011	74
5	183.2	66.2	2.767	98
6	172.8	54.4	3.176	93
7	173.5	62.2	2.789	73
8	176.5	58	3.043	60
9	182.3	70	2.604	79
10	175.8	61.8	2.845	85
11	179.9	63.4	2.837	87
12	164.9	63.7	2.601	97
13	154	47.6	3.235	107
14	166	54	3.074	104
15	167.5	54.3	3.085	71
16	179.1	68	2.634	97
17	166	56.2	2.954	104
18	163.5	51.6	3.169	96
19	171.7	59	2.910	101
20	180.4	74.6	2.418	88
21	178.8	79	2.263	90
22	177	68	2.603	91
23	170.8	61.1	2.795	65
24	159.7	57.3	2.787	59
25	172.2	64.9	2.653	60
26	183.1	71	2.579	54
27	174.8	73.2	2.388	59
28	172	47.9	3.591	108
29	172	60.2	2.857	105
30	167.4	56	2.989	104
31	174.3	60.6	2.876	111
32	172.2	58	2.969	108
33	165.8	51	3.251	110
34	186.5	59	3.161	112
35	178	54	3.305	112
36	157.3	58	2.712	108
37	175.3	60	2.922	108
38	176	60.3	2.919	112
39	178.8	62	2.884	110
40	180.5	62.8	2.874	114
41	173	58	2.983	107
42	174.8	67.2	2.601	107
43	185.4	70.3	2.637	108
44	167.5	53	3.160	109
45	171.7	52.7	3.258	111
46	179.2	66.3	2.701	79
47	174.3	59.2	2.944	93
48	176.7	66.8	2.645	102
49	179.2	60.9	2.942	79

TABLE II—(*Continued*)

No.	Height	Weight	Ratio H:W	Int. Score
50	174	67	2.597	89
51	168.5	60	2.808	81
52	179	61.6	2.906	74
53	170.1	59.4	2.864	103
54	163.7	55.2	2.965	97
55	179.9	71	2.534	78
56	171.2	61.2	2.797	101
57	170	62.2	2.733	65
58	161.4	50	3.228	98
59	172	68.3	2.518	68
60	179.4	68.4	2.623	85
61	159.5	50.8	3.139	71
62	178.5	72.6	2.486	100
63	173.2	66	2.624	59
64	176.5	66.2	2.666	87
65	160.2	54.8	2.923	71
66	173.4	62.2	2.788	89
67	179	68.6	2.609	103
68	181.8	86	2.114	85
69	167.3	59.2	2.826	77
70	175	53.4	3.277	76
71	176.1	60.6	2.906	65
72	181	68.2	2.654	101
73	163.4	61.4	2.661	99
74	170.5	62	2.750	77
75	176	69	2.551	101
76	171	58.8	2.908	110
77	173.6	77.8	2.231	81
78	165.5	66.4	2.492	87
79	171.9	69	2.491	63
80	162.7	48	3.389	69

TABLE III

No.	Height	Weight	Ratio H:W	Int. Score
1	171	59.3	2.883	117
2	165	64.5	2.558	114
3	172	47.9	3.591	108
4	166	62.1	2.673	107
5	154	47.6	3.235	107
6	166	56.2	2.954	104
7	166	54	3.074	104
8	164.1	59	2.781	103
9	182	73	2.493	102
10	166.5	55	3.027	100
11	176	59.8	2.943	98
12	164	48.1	3.411	97
13	169	56.8	2.975	95
14	177.5	69	2.572	94
15	175	52.7	3.320	93
16	164.5	63	2.611	93
17	170	60.4	2.814	91
18	171	59.4	2.879	90
19	155.1	43.1	3.565	89
20	169	61	2.770	89
21	149.5	53.5	2.794	88
22	168	65	2.584	88
23	173	64.6	2.678	87
24	174	55	3.163	87
25	183	67.2	2.723	86
26	186.5	77.8	2.397	86
27	170.5	76.5	2.229	86
28	171	64.4	2.655	86
29	177	55.3	3.201	86
30	175	65	2.692	86
31	167	58	2.879	86
32	170.5	58	2.939	85
33	182	73	2.493	85
34	175	64	2.734	85
35	166	54.4	3.051	85
36	168	65	2.585	84
37	166	51	3.362	84
38	171.5	60.5	2.835	84
39	174	69	2.521	84
40	179	68.5	2.613	83
41	170	69.9	2.432	83
42	161.5	75	2.153	83
43	177	69.4	2.550	83
44	174	60.8	2.861	82
45	164	52.1	3.147	82
46	178	67.5	2.637	82
47	176	57.2	3.077	81
48	166	63	2.635	81
49	174	62.1	2.802	80

TABLE III—(*Continued*)

No.	Height	Weight	Ratio H:W	Int. Score
50	168	56.4	2.979	79
51	172	65.7	2.618	79
52	164	59	2.779	78
53	171	61.5	2.780	78
54	186	72	2.583	78
55	171	62.7	2.727	76
56	157	56.8	2.763	75
57	178.5	67.3	2.652	74
58	160	54.3	2.946	74
59	167	60.8	2.747	74
60	184	61.1	3.011	74
61	182	69.5	2.619	73
62	175	68.6	2.551	73
63	163	56	2.910	73
64	162	63	2.571	73
65	178	63	2.825	72
66	157	63	2.492	72
67	163.5	63	2.595	72
68	157.5	52	3.028	70
69	175	79	2.215	70
70	176	66.5	2.647	68
71	174	57.2	3.041	68
72	171	54	3.167	66
73	177	68	2.603	65
74	172	65	2.646	63
75	171	63.1	2.714	55

TABLE IV

No.	Int.	Length Limbs	Volume Trunk	Morphologic Index
1	79	136	26.73	5.08
2	63	140	26.88	5.21
3	80	142	24.70	5.75
4	117	144	21.57	6.67
5	88	122	20.99	5.81
6	103	133	20.18	6.59
7	70	144	29.56	4.87
8	87	142	21.45	6.62
9	86	149	26.71	5.58
10	68	145	28.72	5.04
11	93	145	21.24	6.82
12	86	139	31.92	4.35
13	95	139	21.02	6.61
14	86	153	32.08	4.77
15	83	141	30.05	4.69
16	89	126	20.26	6.22
17	79	137	21.79	6.28
18	84	140	26.15	5.35
19	76	136	28.85	4.71
20	66	129	22.49	5.73
21	72	132	26.53	4.97
22	83	138	28.96	4.76
23	83	130	29.86	4.35
24	84	138	19.12	7.21
25	86	142	22.77	6.23
26	88	142	24.68	5.75
27	84	142	25.56	5.55
28	86	145	26.73	5.42
29	65	142	25.23	5.62
30	73	133	24.20	5.49
31	86	139	24.18	5.74
32	85	149	31.31	4.75
33	74	140	29.62	4.72
34	108	136	19.91	6.83
35	107	133.5	24.59	5.43
36	104	135	24.34	5.54
37	74	126	26.41	4.77
38	78	157.5	25.38	6.20
39	91	140	22.33	6.27
40	114	137	22.39	6.11
41	73	144.5	25.09	5.75
42	85	139.5	20.65	6.75
43	84	144	26.08	5.52
44	74	146	27.81	5.25
45	55	138.5	25.73	5.38
46	97	133	21.75	6.11
47	75	129.5	23.04	5.62
48	104	138	22.80	6.05
49	100	142	22.32	6.36

TABLE IV—(*Continued*)

No.	Int.	Length Limbs	Volume Trunk	Morphologic Index
50	81	132	27.91	4.73
51	98	143.5	22.47	6.38
52	68	138	23.96	5.96
53	82	140	21.09	6.63
54	73	139	26.42	5.26
55	87	138	25.09	5.50
56	86	141	21.19	6.65
57	102	145	28.21	5.14
58	82	146	26.48	5.51
59	93	136.5	23.39	5.83
60	86	136	24.73	5.49
61	83	143	25.19	5.67
62	85	138	24.78	5.57
63	72	129	23.88	5.40
64	73	136	23.15	5.88
65	72	138	23.66	5.83
66	78	136	20.45	6.65
67	74	138	25.53	5.40
68	90	142	24.20	5.86
69	81	144	23.86	6.03
70	89	137	24.54	5.58
71	70	130	19.59	6.63
72	94	148.5	28.39	5.23
73	82	134	24.79	4.82
74	107	126.5	17.57	7.20
75	78	133	23.72	5.60

TABLE V

No.	Height	Weight	Ratio H:W	Int. Score
1	171	59.3	2.883	117
2	180.5	62.8	2.874	114
3	165	64.5	2.558	114
4	186.5	59	3.161	112
5	178.5	54	3.305	112
6	176	60.3	2.919	112
7	174.3	60.6	2.876	111
8	171.7	52.7	3.258	111
9	165.8	51	3.251	110
10	171	58.8	2.908	110
11	178.8	62	2.884	110
12	167.5	53	3.160	109
13	172	47.9	3.591	108
14	157.3	58	2.712	108
15	172.2	58	2.969	108
16	185.4	70.3	2.637	108
17	175.3	60	2.922	108
18	166	62.1	2.673	107
19	154	47.6	3.235	107
20	174.8	67.2	2.601	107
21	173	58	2.983	107
22	172	60.2	2.857	105
23	167.4	56	2.989	104
24	166	56.2	2.954	104
25	166	54	3.074	104
26	170.1	59.4	2.864	103
27	179	68.6	2.609	103
28	165	53.1	3.107	103
29	164.1	59	2.781	103
30	176.7	66.8	2.645	102
31	182	73	2.493	102
32	184.5	54.2	3.404	101
33	167.6	61.2	2.739	101
34	171.2	61.2	2.797	101
35	181	68.2	2.654	101
36	176	69	2.551	101
37	171.7	59	2.910	101
38	174.4	64.7	2.695	100
39	170	62.3	2.729	100
40	178.5	72.6	2.486	100
41	166.5	55	3.027	100
42	163.4	61.4	2.661	99
43	165.5	60.1	2.754	99
44	183.2	66.2	2.767	98
45	173	62.5	2.768	98
46	162.8	56.4	2.887	98
47	161.4	50	3.228	98
48	176	59.8	2.943	98
49	163.7	55.2	2.965	97

TABLE V—(*Continued*)

No.	Height	Weight	Ratio H:W	Int. Score
50	164	48.1	3.411	97
51	164.9	63.4	2.601	97
52	179.1	68	2.634	97
53	163.5	51.6	3.169	96
54	182.7	62	2.947	95
55	169	56.8	2.975	95
56	167	78.6	2.125	94
57	177.5	69	2.572	94
58	177.1	55.8	3.174	93
59	174.3	59.2	2.944	93
60	175	52.7	3.320	93
61	164.5	63	2.611	93
62	172.8	54.4	3.176	93
63	162.5	70.1	2.318	92
64	177	68	2.603	91
65	178	57.2	3.112	91
66	165.4	51.1	3.236	91
67	170	60.4	2.814	91
68	168.4	59.3	2.840	90
69	178.8	79	2.263	90
70	171	59.4	2.879	90
71	155.1	43.1	3.598	89
72	171	60.8	2.812	89
73	174	67	2.597	89
74	173.4	62.2	2.788	89
75	169	61	2.770	89
76	149.5	53.5	2.794	88
77	180.1	84.8	2.124	88
78	166.5	65	2.562	88
79	168	65	2.584	88
80	180.4	74.6	2.418	88
81	167	53	3.151	87
82	170.4	58.1	2.933	87
83	176.5	66.2	2.666	87
84	173	64.6	2.678	87
85	179.9	63.4	2.837	87
86	165.5	66.4	2.492	87
87	174	55	3.163	87
88	183	67.2	2.723	86
89	186.5	77.8	2.397	86
90	165	54.2	3.044	86
91	175.5	58.9	2.980	86
92	181.6	60.7	2.992	86
93	170.5	76.5	2.229	86
94	171	64.4	2.655	86
95	177	55.3	3.201	86
96	175	65	2.692	86
97	167	58	2.879	86
98	170.5	58	2.939	85

TABLE V—(*Continued*)

No.	Height	Weight	Ratio H:W	Int. Score
99	178	63.4	2.808	85
100	176.1	59.6	2.955	85
101	179.4	68.4	2.623	85
102	181.8	86	2.114	85
103	182	73	2.493	85
104	175	64	2.734	85
105	175.8	61.8	2.845	85
106	166	54.4	3.051	85
107	183	69.5	2.633	84
108	176.5	52.4	3.368	84
109	173.9	66.3	2.623	84
110	163.6	52.6	3.110	84
111	168	65	2.585	84
112	171.5	51	3.362	84
113	171.5	60.5	2.835	84
114	174	69	2.521	84
115	174.4	59.5	2.931	83
116	179	68.5	2.613	83
117	171	58.6	2.918	83
118	170	69.9	2.432	83
119	161.5	75	2.153	83
120	177	69.4	2.550	83
121	164.9	70	2.356	82
122	174.4	64.4	2.708	82
123	174	60.8	2.861	82
124	164	52.1	3.147	82
125	178	67.5	2.637	82
126	168.8	55.7	3.030	81
127	166.6	60	2.777	81
128	168.5	60	2.808	81
129	173.6	77.8	2.231	81
130	176	57.2	3.077	81
131	166	63	2.635	81
132	162	48	3.375	80
133	183.2	67	2.734	80
134	179.3	70.2	2.554	80
135	174	62.1	2.802	80
136	169.1	65	2.602	79
137	175.4	61	2.875	79
138	182.3	70	2.604	79
139	179.1	66.3	2.701	79
140	179.2	60.9	2.942	79
141	168	56.4	2.979	79
142	172	65.7	2.618	79
143	164	59	2.779	78
144	164	46	3.565	78
145	159.1	65	2.448	78
146	163.7	49.3	3.320	78
147	179.9	71	2.534	78

TABLE V—(*Continued*)

No.	Height	Weight	Ratio H:W	Int. Score
148	171	61.5	2.780	78
149	186	72	2.583	78
150	170	56.6	3.003	77
151	167.3	59.2	2.826	77
152	170.5	62	2.750	77
153	157.7	59	2.673	76
154	175	53.4	3.277	76
155	171	62.7	2.727	76
156	162.5	62	2.621	75
157	157	56.8	2.764	75
158	178.5	67.3	2.652	74
159	169.6	61.3	2.767	74
160	166.3	68.3	2.435	74
161	179	61.6	2.906	74
162	160	54.3	2.946	74
163	167	60.8	2.747	74
164	184	61.1	3.011	74
165	182	69.5	2.619	73
166	173.5	62.2	2.789	73
167	175	68.6	2.551	73
168	163	56	2.910	73
169	162	63	2.571	73
170	168.7	66.3	2.544	72
171	163.4	59.2	2.760	72
172	172	69.2	2.485	72
173	178	63	2.825	72
174	157	63	2.492	72
175	163.5	63	2.595	72
176	181.6	72	2.522	71
177	167.5	54.3	3.085	71
178	159.5	50.8	3.139	71
179	160.2	54.8	2.923	71
180	175.5	61.1	2.872	71
181	157.5	52	3.028	70
182	175	79	2.215	70
183	161.1	66.5	2.421	69
184	180	68.4	2.633	69
185	173	56	3.089	69
186	127.6	48	3.389	69
187	171.8	56	3.068	68
188	177.4	68.2	2.601	68
189	179	55.6	3.219	68
190	172	68.3	2.518	68
191	176	66.5	2.647	68
192	174	57.2	3.041	68
193	170.3	54.3	3.136	67
194	171	54	3.167	66
195	165	62.2	2.653	66
196	176.5	66	2.674	66

TABLE V—(*Continued*)

No.	Height	Weight	Ratio H:W	Int. Score
197	171.5	83	2.066	66
198	171.5	61	2.811	65
199	170	67	2.537	65
200	171.4	62	2.764	65
201	168.3	56	3.005	65
202	166.4	74.2	2.243	65
203	170	62.2	2.733	65
204	176.1	60.6	2.906	65
205	177	68	2.603	65
206	170.8	61.1	2.795	65
207	179.5	74.5	2.409	64
208	178.3	64.7	2.756	64
209	176	65.5	2.687	64
210	171.9	69	2.491	63
211	172	65	2.646	63
212	163.3	60	2.722	62
213	176.5	73.8	2.392	62
214	172.2	64.9	2.653	60
215	176.5	58	3.043	60
216	174.8	73.2	2.388	59
217	187	81.4	2.297	59
218	173.2	66	2.624	59
219	159.7	57.3	2.787	59
220	171	63	2.714	55
221	183.1	71	2.579	54

TABLE VI

No.	Int. Score	Lung Capacity	No.	Int. Score	Lung Capacity
1	117	460	50	86	400
2	114	350	51	85	465
3	107	450	52	85	330
4	107	250	53	85	400
5	104	390	54	85	565
6	104	400	55	85	410
7	103	390	56	85	360
8	103	320	57	84	470
9	102	450	58	84	390
10	101	435	59	84	460
11	101	390	60	84	370
12	100	360	61	84	340
13	100	430	62	84	380
14	100	330	63	84	380
15	99	240	64	84	460
16	98	340	65	83	350
17	98	250	66	83	480
18	98	350	67	83	370
19	97	300	68	83	410
20	95	280	69	82	290
21	94	400	70	82	440
22	94	440	71	82	400
23	93	410	72	82	320
24	93	400	73	82	330
25	93	430	74	81	460
26	92	350	75	81	380
27	91	410	76	81	400
28	91	350	77	81	400
29	90	410	78	80	330
30	90	410	79	80	440
31	89	260	80	80	420
32	89	390	81	80	420
33	89	470	82	79	420
34	88	330	83	79	390
35	88	350	84	79	350
36	88	380	85	79	460
37	88	400	86	78	350
38	87	300	87	78	230
39	87	330	88	78	350
40	87	420	89	78	370
41	86	500	90	77	430
42	86	450	91	76	310
43	86	300	92	75	430
44	86	440	93	75	240
45	86	370	94	74	380
46	86	480	95	74	250
47	86	380	96	74	380
48	86	370	97	74	360
49	86	350	98	74	410

TABLE VI—(*Continued*)

No.	Int. Score	Lung Capacity	No.	Int. Score	Lung Capacity
99	73	360	118	68	380
100	73	340	119	67	330
101	73	350	120	66	410
102	73	410	121	66	470
103	72	360	122	66	360
104	72	380	123	65	330
105	72	360	124	65	400
106	72	330	125	65	500
107	72	340	126	65	350
108	71	420	127	65	370
109	70	320	128	65	340
110	70	410	129	64	450
111	69	420	130	64	390
112	69	470	131	64	500
113	69	410	132	63	330
114	68	460	133	62	300
115	68	460	134	62	410
116	68	350	135	59	520
117	68	450	136	55	440

TABLE VII

No.	Length Limbs	Volume Trunk	Morph. Index	Height in cm.	Weight in lbs.	Ratio H:W
1	126.5	18.84	671	157.5	113	139
2	123.9	20.28	610	152	98	155
3	139.4	24.19	576	173	120	144
4	140.2	25.70	545	172.5	135	127
5	129.5	24.60	526	161	121	133
6	136	25.97	523	166	115	144
7	138.1	26.50	521	171.5	135	127
8	141.6	27.40	516	169	124	136
9	146.7	28.50	514	179	135	132
10	157.7	30.69	513	187.5	176	106
11	150.3	29.40	511	178.5	128	139
12	145.5	28.67	507	172	132	130
13	152.4	30.31	502	181	133	136
14	156.5	31.32	499	191	145	131
15	134.7	27.40	491	169	128	132
16	132.3	26.97	490	166	121	137
17	147.3	29.70	495	181	146	123
18	144	30.18	477	172.2	145	119
19	143	30.00	476	174.5	160	109
20	144.4	30.44	474	179	151	118
21	145.6	31.30	465	179	139	128
22	146.5	31.80	460	178	149	119
23	142.7	31.00	460	183.5	146	125
24	136.3	30.10	452	170	126	134
25	140	31.20	448	181	155	116
26	145.6	32.70	445	181	160	113
27	133.8	30.41	440	172	131	131
28	144.1	32.53	442	179	145	123
29	137	31.43	436	167	145	115
30	138.1	31.73	435	171.5	135	127
31	138.4	32.00	432	170	146	116
32	130.8	30.70	426	162.5	135	120
33	141	33.04	426	171	145	117
34	140.3	33.51	418	172	144	119
35	144.9	34.77	416	180	158	114
36	155	37.51	413	189	175	108
37	132.6	32.46	408	170	145	117
38	144.9	35.44	408	177	166	106
39	137.6	34.61	397	164	147	111
40	134.4	33.83	397	173.5	142	122
41	142.4	35.90	396	175.5	165	106
42	127.7	32.02	398	167.5	130	128
43	138.8	35.83	387	172.5	150	115
44	142.2	37.05	383	177.5	154	114
45	138.8	36.34	381	172	150	115
46	145.5	38.34	379	180	165	109
47	138.2	36.68	376	170	161	105
48	130.6	35.00	373	175	152	115
49	148.5	40.68	365	180.5	175	103
50	132	36.57	360	170	160	106

SYNOPSIS OF THE TABLES

TABLES No. I, II and III give height (cm.), weight (kg.) ratio height to weight and intelligence ratings (Thorndike Intelligence Examination) of groups of 100, 80 and 75 college students.

TABLE No. V gives the same subjects of tables I, II and III in a single group of 221. Some subjects appeared in more than one table.

TABLE No. IV gives length of limbs, volume of trunk and morphologic index of the same individuals of table No. III.

TABLE No. VI gives lung capacity of 136 subjects among the group of table V.

Table VII—giving length of limbs, volume of trunk, morpholog'c index, height, weight and ratio of height to weight in a group of 50 University students.

BIBLIOGRAPHY

1. KLINE, L. W. Truancy as related to the migratory instinct. *Pedagogical Seminary*, 5, 1898.
2. SMEDLEY, F. W. Report of the Department of child-study and pedagogic investigation. Reprint from 46th Annual Report Board Education, Chicago, 1899–1900, 1900–1901.
3. SACK, N. Physical development of the children in the middle schools of Moscow, 1892. Quoted by Whipple in Manual of mental and physical tests. Baltimore, 1914.
4. GRATIANOFF. Quoted by Whipple, *ibidem*.
5. PORTER, W. T. The growth of St. Louis children. *Transactions Academy of Sciences*, St. Louis, **6**, 1894.
   Physical basis of precocity and dullness, *Ibid.*, **6**, 1893–4.
6. MACDONALD, A. Experimental study of school children, etc. Report United States Commissioner of Education, 1899.
7. DEBUSK, B. W. Height, weight, vital capacity and retardation. *Pedagogical Seminary*, **20**, 1913.
8. WEST, G. Observations on the relation of physical development to intellectual ability made on the school children of Toronto, Canada. *Science*, n. s., **4**, 1896.
9. GILBERT, J. A. Researches on the mental and physical development of school children. *Studies from the Yale Psychological Laboratory*, **2**, 1894.
   Researches upon school children and college students. *University of Iowa Studies in Psychology*, **11**, 1897.
10. DE GIOVANNI, A. Commentari di clinica medica. Padova, 1889–1893.
    Morfologia del corpo umano. Milano, 1891.
    Commentari, Parte generale. Milano, 1904.
    Studi di morfologia clinica. Vol. 2. Milano 1905.

Commentari di clinica medica desunti dalla morfologia del corpo umano. Parte speciale. Vol I–II. Milano, 1907–1908.

Nuovi studi di morfologia clinica. Vol. IV. Milano, 1909.

11. VIOLA, G. La tecnica antropometrica a scopo clinico. Le dimensioni dell' uomo medio normale veneto. Padova, 1905.

L'indirizzo individualistico in medicina e il metodo morfologico del De Giovanni. Milano, 1905.

La tecnica antropometrica a scopo clinico: Criteri e metodo di comparazione antropometrica fra le individualità umane. Padova, 1905.

Le leggi di correlazione morfologica dei tipi individuali: La seriazione asimmetrica del "valore del tronco" e i suoi rapporti con la patologia. Padova, 1908.

Le leggi di correlazione morfologica dei tipi individuali: L'antropometria a scopo fisiognostico. Padova, 1908.

Le leggi di correlazione morfologica dei tipi individuali: L'abito tisico e l'abito apoplettico quali prodotti di una legge naturale di deformazione del tipo etnico. Padova, 1909.

Il metodo antropometrico "di deformazione" per la classificazione clinica dei tipi morfologici. Padova, 1909.

Le leggi di correlazione morfologica dei tipi individuali: L'abito tisico e l'abito apoplettico nei rapporti con l'infantilismo e la precocità. Roma, 1909.

12. STRATZ, C. N. Naturgeschichte des Menschen. Stuttgart, 1904.
13. RANKE, J. Der Mensch. Vol II. Leipzig, 1894.
14. SCHLESINGER, F. *Zeitschrift für Kinderheilkunde*, 1920, 27, 207.
15. PENDE, N. Endocrinologia. 2*a* edizione. Milano, 1921.
16. NACCARATI, S. The Oculocardiac Reflex (Dagnini-Aschner Phenomenon); its use in medicine and psychology. *Archives of Neurology and Psychiatry*, 5, No. 1, 1921.

$1.50

NAME	DATE DUE

S